

Retrospective Vaccination Coverage Survey

2011-2012 Results (School Year 2015-2016)



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Background

The Kansas Kindergarten Immunization Coverage Assessment is an annual study conducted by the Kansas Department of Health and Environment (KDHE) to assess vaccination coverage among kindergarten students. The population for this study includes kindergarten students between the ages of five and seven years on the first day of the academic year and enrolled in either a public or private school in Kansas. This retrospective study utilized data from the 2015-2016 Kindergarten Immunization Coverage Assessment to calculate vaccination coverage levels among those children when they were 24 and 35 months of age.

The Advisory Committee for Immunization Practices (ACIP) recommends children by 24 months of age receive (Table 1)¹:

Table 1: ACIP Birth to 6 Years Immunization Recommendations

	Vaccine For	Number of Doses	Healthy People 2020 Coverage Goals
DTaP4	Diphtheria, Tetanus, Pertussis	4	90%
HepB3	Hepatitis B	3	
Hib3	<i>Haemophilus influenzae</i> type b	3	
MMR1	Measles, Mumps, Rubella	1	
PCV4	Pneumococcal	4	
Polio3	Polio	3	
Var1	Varicella	1	85%
HepA2	Hepatitis A	2	
4-3-1-3-3-1-4	DTaP4, Polio3, MMR1, Hib3, HepB3, Var1, PCV4	N/A	

Methods

Data collection

Each Kansas public and private school with a kindergarten class received a letter requesting participation in this study which were co-signed by the Secretary of KDHE and the Commissioner of the Kansas State Department of Education. These letters specified the number of records requested, based upon a simple random sample and kindergarten enrollment population which was used to ensure adequate sample size from each Kansas County. Sampling weights were calculated based on county size and school type (public or private). Schools were assigned to one of three groups:

¹ Child and Adolescent Schedule from Centers for Disease Control and Prevention

- Schools that sent 30 vaccination records selected at random
- Schools that sent all vaccination records
 - For schools with less than 30 kindergarten students enrolled
- Schools that sent no vaccination records

Records could include exemption records based on how records were requested to be selected.

Participating schools could submit Kansas Certificates of Immunizations (KCIIs) or any other form of paper vaccination record, including printouts from computerized record keeping programs, to KDHE. All personal identifiers were removed from records, except date of birth, to ensure confidentiality. This sampling methodology is different from assessments prior to 2014-2015 so past data cannot be utilized for comparison. To be included in analysis, data had to be received by a set cut-off date, as indicated on the participation letter; additionally, data could not be utilized if date of birth was missing or date of vaccine was illegible.

Data Analysis

Consistent with previous studies, sample population comprised of children with date of birth on records that met the age requirement for inclusion. Point estimates of coverage levels and 95% confidence intervals (95% CI) were analyzed for:

- DTaP4, Polio3, MMR1, Hib3, HepB3, Var1, PCV4, HepA2, and the 4-3-1-3-3 series
 - Coverage at 24 months of age
 - Coverage at 35 months of age

A child was considered up-to-date (UTD) for the 4-3-1-3-3-1-4 series if he or she was UTD for DTaP4, Polio3, MMR1, Hib3, HepB3, Var1, and PCV4 vaccinations. Results were compared to results from the National Immunization Survey (NIS); a population-based, random, telephone survey conducted by the Centers for Disease Control and Prevention (CDC).

Sample weights were calculated using the number of kindergarteners enrolled in a county by school type and the number of records included in analysis for that county. Furthermore, counties were categorized by population density ([Appendix 1](#)), and grouped into “urban” (≥ 150 persons per square mile), “moderately populated” (20-149.9 persons per square mile), and “rural” (≤ 19.9 persons per square mile) with vaccination coverage compared among these groups.

Results

There were 356 schools that provided 8,328 records for this study (Table 2). Schools not included were either part of the group of schools not selected to submit records, did not respond to the request for records, or did not respond in time. Demographic information was not collected so study population

demographics such as gender, race, and ethnicity were not able to be reported. All 105 Kansas counties were represented in the analysis.

Table 2: Study population, by academic year, Kansas

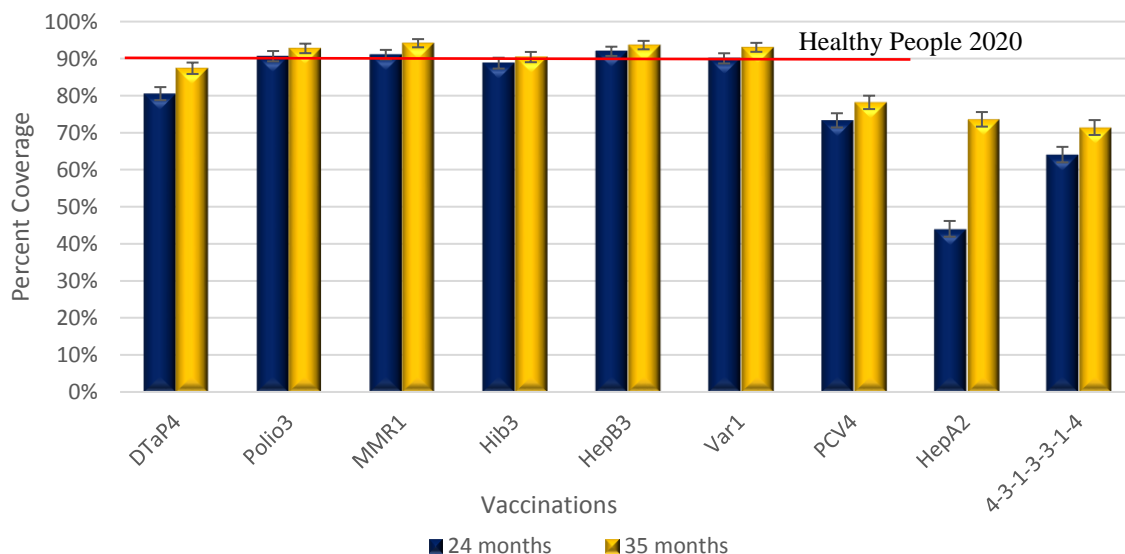
Study Year	School Year	Response Rate	Public Schools	Private Schools	Total Records	Counties Represented (out of 105)
2010-2011	2014-2015	94%	349	40	9,219	102
2011-2012	2015-2016	94%	302	54	8,328	105

Statewide Vaccination Coverage

At 24 months of age, all vaccinations required for entry into kindergarten (DTaP4, Polio3, MMR1, Var1 and HepB3) were above 80%. HepB3 had the highest coverage at 91.9% and HepA2 had the lowest coverage at 44% (Figure 1). Polio3, HepB3, and Var1 met Healthy People 2020 (HP2020) goals of 90% coverage

Coverage rates increased among 35 month old children for all vaccinations. A significant increase in vaccination coverage was observed for DTaP4, MMR1, Var1, PCV4, HepA2 and the 4-3-1-3-3-1-4 series; HepA2 coverage increased the most at 29.6%. Hib3 increased 1.3% and now met the HP2020 goal of 90% coverage. However, DTaP4, PCV4, HepA2 and 4-3-1-3-3-1-4 series were still below national metrics.

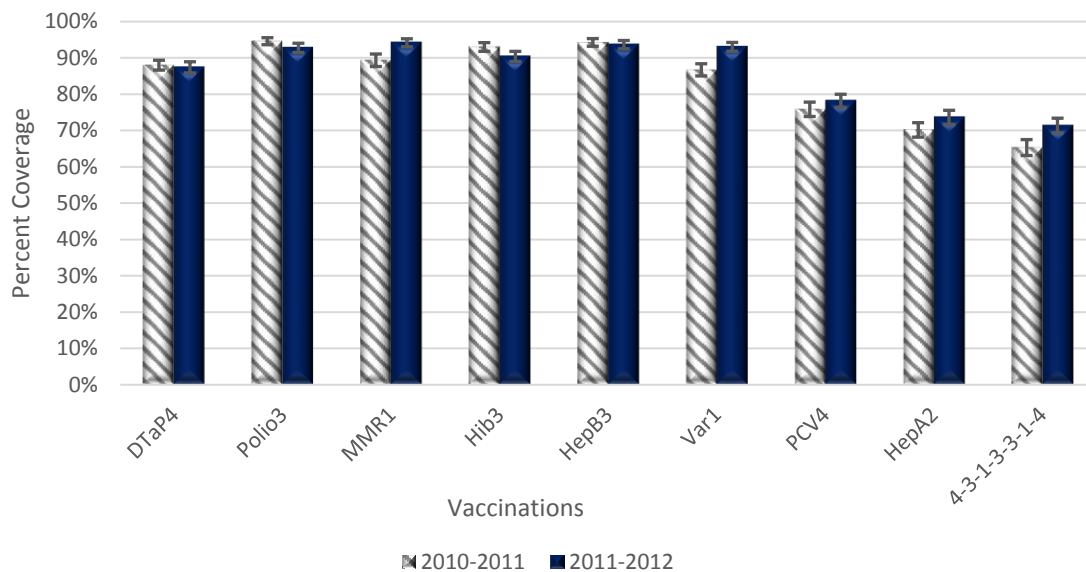
Figure 1: Statewide vaccination coverage at 24 and 35 months of age, Kansas, 2011-2012



Comparison of vaccination coverage at 35 months of age to the previous year's retrospective study revealed significant changes in coverage. Significant decrease in Polio3 coverage was observed in 2011-2012 compared to 2010-2011; conversely, MMR1, Var1, and the 4-3-1-3-3-1-4 series significantly

increased (Figure 2). Among the 2011-2012 cohort, MMR1 and Var1 met HP2020 goals that were not met in the previous year's study. Var1 coverage experienced the greatest increase (6.3%), while Hib3 experienced the greatest decrease (-2.6%) among Kansas children aged 35 months. DTaP4, HepB3, PCV4, and HepA2 coverage did not experience a significant change between cohort years.

Figure 2: Vaccination coverage at 35 months of age by year, Kansas



National Immunization Survey (NIS) Coverage at 19-35 Months of Age

Coverage for DTaP4, MMR1, Hib3, HepB3, Var1, HepA2, and 4-3-1-3-3-1-4 series were significantly higher in the current retrospective study for children 35 months of age when compared to the National NIS vaccination coverage among children 19-35 months of age (Table 3). Alternatively, PCV4 coverage was significantly lower than National NIS vaccination coverage and Polio3 coverage was not significantly different than coverage in the NIS respondents.

Table 3: Vaccination coverage level by study type

	Kansas Retrospective 35-month-olds	United States NIS [§] 19-35-month-olds
DTaP4	87.4% *	82.5%
Polio3	92.8%	92.8%
MMR1	94.2% *	90.8%
Hib3	90.4% *	80.9%
HepB3	93.7% *	89.7%
Var1	93.1% *	90.2%
PCV4	78.2% *	81.9%
HepA2	73.6% *	53.0%

4-3-1-3-3-1-4 series	71.4%*	68.4%
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[§]Based on 2012 NIS, children aged 19-35 months of age

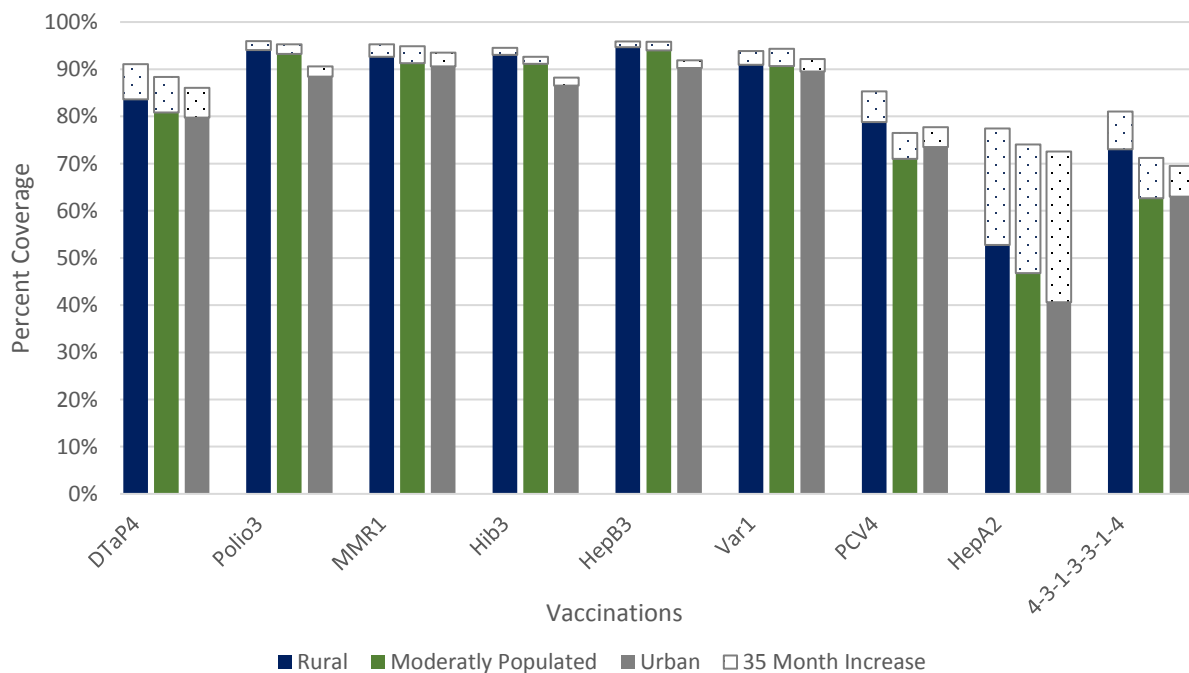
* Significantly different from national NIS

Vaccination Coverage by County Type

Counties were classified based on population densities and vaccination coverage was compared. Among 24 month old children, rural counties were observed to have the highest coverage for all vaccinations versus counties with greater population densities (Figure 3). HepB3 had the highest coverage in rural and moderately populated counties (94.6% and 94.0%, respectively) while MMR1 had the highest coverage in urban counties (90.6%). Rural and moderately populated counties met HP2020 goals for Polio3, MMR1, Hib3, HepB3, and Var1; urban counties met HP2020 national metrics for MMR1.

An increase in coverage for all vaccinations for 35 month old children was observed, regardless of county population density. The greatest increase was in HepA2 among children in urban counties, with a 32.0% increase in coverage. Vaccine coverage that met the HP2020 goals now included DTaP4 and 4-3-1-3-3-1-4 series in rural counties and Polio3, HepB3, and Var1 in urban counties with the increase in coverage at 35 months. Vaccination coverage by county is in [Appendix 2](#).

Figure 3: Vaccination coverage of Kansas children at 24 and 35 months of age by county type, 2011-2012



Discussion:

At 24 months of age, children in this study had over 80% coverage for all vaccinations required for entry into school. Coverage rates for the 4-3-1-3-3-1-4 series was lower than individual vaccination rates due to the lower number of children who are UTD for all seven of the vaccines in this series. Between 24 and 35 months of age all vaccinations increased in coverage, HepA2 coverage had the greatest increase. This drastic increase may be due to the ACIP recommendations for initial dose of HepA2 to be given between 12 and 23 months with the second dose to be given 6 to 18 months later. Compared to National NIS respondents, participants in this retrospective study had significantly higher coverage for all vaccination except PCV4 which was lower in this study compared with the national NIS results; this vaccine is not required to enter kindergarten in Kansas and may reflect a lack of recording of these vaccinations on submitted records, the data source for this study.

Vaccination coverage variance by county population density groups (rural vs. moderately populated vs. urban) was observed. Children in rural counties had higher vaccination coverage for all vaccinations at 24 and 35 months compared to counties with greater population densities. Urban counties had the lowest vaccination coverage among the other county types regardless of the age examined. This result was unexpected as urban counties have an increased number of providers, including VFC providers, compared to rural counties where access to care is less. Factors not assessed in this study may be contributing to this finding, including insurance status of child, socioeconomic status, and vaccine hesitancy among parents.

Vaccination coverage is of great public health importance. By having greater vaccination coverage this provides protection for persons who are not able to be vaccinated by disrupting chains of infection and slowing the spread of vaccine preventable diseases (VPDs). Unvaccinated or non-UTD children are at an increased risk for not only contracting VPDs but also spreading disease to other unimmunized or under-immunized individuals (e.g., infants) or other high-risk persons. Therefore, it is important that the number of fully vaccinated children remain high. Yet, due to increasing numbers of unvaccinated and under-immunized individuals, the United States has experienced increased incidence of VPDs; including measles. In 2012, Kansas experienced an outbreak of measles after two people traveled to an area where measles was endemic. A total of six people became infected, with two persons being hospitalized and 314 persons exposed. Among the persons with measles 67% were unvaccinated or under-vaccinated; well below the 95% needed for herd immunity to prevent spread of measles infection.

Limitations

A limitation of this study is Hib3, HepA2, and PCV4 are not required for school entry and may not be consistently reported on the vaccination record, thus the coverage estimates for these vaccines as well as the 4-3-1-3-3-1-4 vaccine series may be artificially low. Additionally, no descriptive data was collected about sex, race, or ethnicity; preventing analysis for improved targeting, effective messaging, and the role of these factors play in likelihood of immunization.

For children with history of varicella disease marked on the vaccination record, date of disease was rarely given. Without knowing the date of disease, it could not be definitively determined that the disease took place before the first scheduled dose of varicella containing vaccine. Thus children with marked history of disease, regardless of the number of varicella vaccinations were not included in analysis for varicella coverage. This amounted to 25 (0.3%) records being removed from varicella coverage analysis.

Strengths

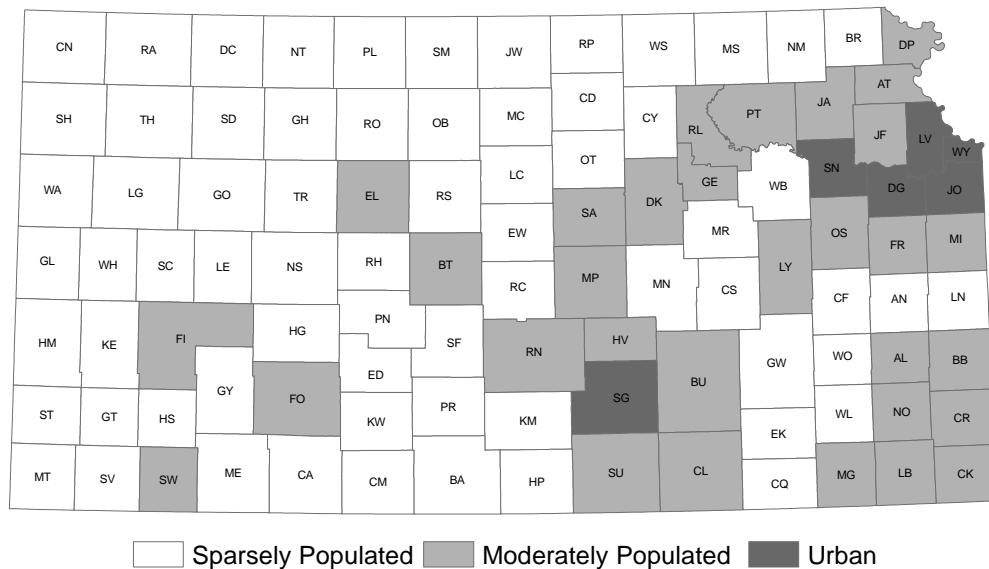
Despite the limitations, this retrospective vaccination study provides a good estimate of the vaccination coverage levels among 24 and 35 month old children in Kansas. This document allows state and local officials to identify counties and regions with low vaccine coverage levels in order to focus implementation of enhanced vaccination delivery methods and provide educational campaigns that can aid in Kansas achieving national vaccination coverage metrics. Additionally, this study had a high response rate in terms of survey participation; 94% of schools that received requests for information sent in vaccinations records. This enabled results to accurately be generalized to all Kansas children in this age group.

Appendix 1: Kansas counties categorized based on population density, 2011

Sparsely Populated	
Anderson	Marshall
Barber	Meade
Brown	Mitchell
Chase	Morris
Chautauqua	Morton
Cheyenne	Nemaha
Clark	Ness
Clay	Norton
Cloud	Osborne
Coffey	Ottawa
Comanche	Pawnee
Decatur	Phillips
Edwards	Pratt
Elk	Rawlins
Ellsworth	Republic
Gove	Rice
Graham	Rooks
Grant	Rush
Gray	Russell
Greeley	Scott
Greenwood	Sheridan
Hamilton	Sherman
Harper	Smith
Haskell	Stafford
Hodgeman	Stanton
Jewell	Stevens
Kearny	Thomas
Kingman	Trego
Kiowa	Wabaunsee
Lane	Wallace
Lincoln	Washington
Linn	Wichita
Logan	Wilson
Marion	Woodson

Moderately Populated	
Allen	Jackson
Atchison	Jefferson
Barton	Labette
Bourbon	Lyon
Butler	McPherson
Cherokee	Miami
Cowley	Montgomery
Crawford	Neosho
Dickinson	Osage
Doniphan	Pottawatomie
Ellis	Reno
Finney	Riley
Ford	Saline
Franklin	Seward
Geary	Sumner
Harvey	

Urban
Douglas
Johnson
Leavenworth
Sedgwick
Shawnee
Wyandotte



Persons per Square Mile in Peer Groups

Sparsely Populated = ≤ 19.9

Moderately Populated = 20 – 149.9

Urban = ≥ 150.0

Appendix 2: Vaccination coverage levels of children 35 months of age for Kansas counties 2011-2012*§

COUNTY	DTaP4	Polio3	MMR1	Hib3	HepB3	Var1	PCV4	HepA2	4-3-1-3-3-1-4
STATEWIDE	87%	93%	94%	90%	94%	93%	78%	74%	71%
ALLEN	86%	97%	96%	96%	96%	94%	77%	73%	74%
ANDERSON	87%	93%	94%	93%	96%	94%	84%	57%	84%
ATCHISON	87%	99%	99%	99%	98%	99%	81%	73%	80%
BARBER	87%	94%	90%	94%	96%	90%	80%	71%	80%
BARTON	90%	95%	93%	95%	96%	96%	88%	83%	80%
BOURBON	81%	89%	86%	92%	92%	89%	77%	49%	68%
BROWN	84%	94%	95%	94%	91%	90%	81%	63%	73%
BUTLER	88%	96%	96%	94%	97%	94%	83%	75%	77%
CHASE	96%	100%	92%	100%	92%	92%	88%	85%	65%
CHAUTAUQUA	100%	100%	100%	97%	97%	100%	89%	91%	89%
CHEROKEE	84%	96%	96%	93%	97%	93%	82%	65%	72%
CHEYENNE	86%	96%	93%	96%	96%	87%	84%	54%	71%
CLARK	100%	100%	100%	100%	90%	100%	100%	70%	90%
CLAY	92%	97%	97%	95%	95%	97%	93%	84%	90%
CLOUD	88%	93%	86%	93%	92%	85%	78%	71%	71%
COFFEY	89%	94%	91%	92%	94%	92%	83%	70%	81%
COMANCHE	93%	97%	97%	97%	97%	87%	70%	77%	70%
COWLEY	83%	95%	96%	95%	97%	96%	74%	76%	72%
CRAWFORD	91%	97%	94%	91%	94%	94%	65%	68%	57%
DECATUR	83%	92%	88%	92%	92%	92%	79%	75%	75%
DICKINSON	86%	94%	93%	92%	95%	92%	82%	72%	77%
DONIPHAN	90%	96%	95%	96%	98%	95%	83%	68%	77%
DOUGLAS	84%	87%	92%	86%	90%	90%	74%	72%	61%
EDWARDS	95%	98%	95%	95%	95%	97%	82%	77%	80%
ELK	93%	100%	97%	97%	90%	93%	81%	71%	68%
ELLIS	96%	100%	98%	99%	98%	97%	69%	91%	67%
ELLSWORTH	95%	98%	98%	97%	97%	96%	88%	92%	84%
FINNEY	89%	97%	96%	96%	96%	94%	79%	74%	75%
FORD	91%	98%	99%	95%	97%	98%	86%	79%	83%
FRANKLIN	84%	89%	93%	89%	94%	94%	79%	72%	71%
GEARY	88%	94%	95%	96%	92%	95%	82%	74%	70%
GOVE	92%	100%	92%	100%	100%	92%	83%	75%	83%
GRAHAM	97%	97%	97%	97%	97%	93%	93%	93%	90%
GRANT	90%	97%	97%	93%	97%	93%	90%	79%	86%
GRAY	92%	97%	93%	91%	97%	93%	90%	82%	82%
GREELEY	96%	96%	96%	96%	91%	91%	96%	87%	87%
GREENWOOD	94%	95%	98%	97%	95%	95%	94%	72%	89%
HAMILTON	87%	97%	100%	97%	97%	100%	80%	90%	73%
HARPER	93%	100%	98%	93%	96%	97%	88%	80%	84%
HARVEY	90%	94%	92%	98%	96%	90%	78%	67%	69%
HASKELL	85%	88%	94%	88%	95%	85%	66%	70%	65%
HODGEMAN	95%	100%	100%	95%	95%	100%	81%	86%	71%
JACKSON	95%	97%	97%	97%	95%	95%	93%	81%	88%
JEFFERSON	87%	96%	99%	97%	95%	97%	84%	76%	76%

COUNTY	DTaP4	Polio3	MMR1	Hib3	HepB3	Var1	PCV4	HepA2	4-3-1-3-3-1-4
STATEWIDE	87%	93%	94%	90%	94%	93%	78%	74%	71%
JEWELL	74%	89%	96%	89%	96%	89%	74%	37%	70%
JOHNSON	88%	92%	94%	91%	91%	93%	83%	74%	74%
KEARNY	92%	98%	96%	95%	99%	96%	87%	72%	86%
KINGMAN	87%	91%	95%	93%	94%	95%	71%	66%	69%
KIOWA	100%	100%	100%	100%	100%	100%	100%	86%	100%
LABETTE	82%	91%	95%	93%	95%	94%	75%	69%	69%
LANE	100%	100%	100%	100%	100%	100%	100%	100%	100%
LEAVENWORTH	91%	92%	90%	85%	91%	88%	77%	74%	66%
LINCOLN	97%	97%	97%	97%	97%	97%	97%	87%	97%
LINN	85%	95%	93%	87%	95%	91%	76%	62%	65%
LOGAN	98%	100%	98%	98%	100%	100%	89%	83%	87%
LYON	90%	92%	94%	93%	98%	95%	85%	75%	80%
MARION	87%	91%	91%	89%	93%	85%	84%	64%	77%
MARSHALL	96%	98%	98%	98%	97%	98%	93%	86%	92%
MCPHERSON	89%	95%	91%	64%	93%	90%	26%	62%	25%
MEADE	91%	94%	94%	100%	100%	94%	76%	82%	73%
MIAMI	92%	94%	93%	66%	97%	95%	60%	69%	55%
MITCHELL	92%	97%	95%	96%	96%	95%	91%	85%	84%
MONTGOMERY	80%	95%	93%	95%	99%	94%	68%	72%	65%
MORRIS	91%	98%	96%	98%	97%	96%	76%	75%	74%
MORTON	91%	100%	100%	100%	100%	92%	72%	63%	68%
NEMAHA	95%	97%	99%	98%	98%	97%	87%	81%	84%
NEOSHO	91%	94%	97%	91%	98%	98%	22%	81%	21%
NESS	100%	100%	100%	100%	100%	100%	96%	91%	96%
NORTON	100%	100%	100%	100%	100%	98%	97%	93%	95%
OSAGE	84%	87%	89%	83%	85%	90%	77%	77%	66%
OSBORNE	93%	96%	93%	93%	93%	93%	89%	56%	85%
OTTAWA	94%	95%	95%	94%	97%	94%	86%	80%	83%
PAWNEE	94%	96%	96%	96%	96%	95%	90%	83%	88%
PHILLIPS	98%	100%	100%	100%	98%	97%	90%	90%	87%
POTTAWATOMIE	82%	92%	87%	87%	92%	92%	78%	66%	69%
PRATT	83%	93%	94%	88%	98%	92%	81%	77%	74%
RAWLINS	90%	100%	97%	93%	100%	97%	80%	73%	77%
RENO	88%	95%	95%	93%	95%	92%	74%	70%	70%
REPUBLIC	97%	97%	97%	97%	93%	93%	93%	93%	87%
RICE	88%	91%	94%	91%	94%	90%	81%	74%	77%
RILEY	91%	97%	96%	94%	95%	95%	84%	76%	79%
ROOKS	91%	98%	94%	98%	98%	98%	85%	87%	77%
RUSH	89%	100%	100%	78%	100%	100%	89%	89%	78%
RUSSELL	88%	99%	96%	96%	99%	96%	88%	83%	88%
SALINE	95%	99%	98%	97%	100%	98%	87%	89%	85%
SCOTT	100%	100%	100%	97%	97%	97%	97%	80%	97%
SEDGWICK	83%	88%	93%	88%	94%	90%	73%	70%	65%
SEWARD	92%	98%	98%	98%	98%	94%	82%	84%	79%
SHAWNEE	92%	96%	97%	95%	96%	98%	92%	88%	87%
SHERIDAN	96%	100%	100%	96%	100%	100%	93%	82%	93%

COUNTY	DTaP4	Polio3	MMR1	Hib3	HepB3	Var1	PCV4	HepA2	4-3-1-3-3-1-4
STATEWIDE	87%	93%	94%	90%	94%	93%	78%	74%	71%
SHERMAN	93%	97%	100%	100%	100%	100%	83%	83%	80%
SMITH	93%	98%	98%	98%	98%	98%	91%	79%	91%
STAFFORD	97%	100%	97%	97%	100%	95%	90%	90%	86%
STANTON	87%	93%	97%	93%	90%	97%	90%	80%	73%
STEVENS	79%	87%	88%	87%	91%	88%	70%	60%	66%
SUMNER	82%	93%	94%	91%	96%	94%	75%	61%	71%
THOMAS	95%	97%	94%	96%	95%	95%	91%	91%	86%
TREGO	94%	94%	94%	94%	94%	88%	94%	88%	88%
WABAUNSEE	87%	100%	92%	95%	97%	86%	87%	78%	76%
WALLACE	100%	100%	100%	100%	100%	100%	100%	100%	100%
WASHINGTON	98%	98%	97%	98%	97%	98%	90%	93%	87%
WICHITA	93%	97%	93%	97%	100%	87%	87%	73%	87%
WILSON	87%	96%	91%	96%	96%	91%	82%	72%	80%
WOODSON	93%	93%	93%	93%	87%	97%	90%	80%	80%
WYANDOTTE	83%	90%	95%	76%	89%	94%	64%	62%	58%

* Based on the retrospective survey for the school year starting 2015.

§ Due to Hib3 and PCV4 not being required for school entry, these vaccines may not consistently be reported on the vaccination record, thus decreasing coverage levels for the individual vaccines, as well as the 4-3-1-3-3-1-4 series. This is evident for several counties that have low coverage levels for the 4-3-1-3-3-1-4 series as well as low Hib3 and PCV4 coverage levels.